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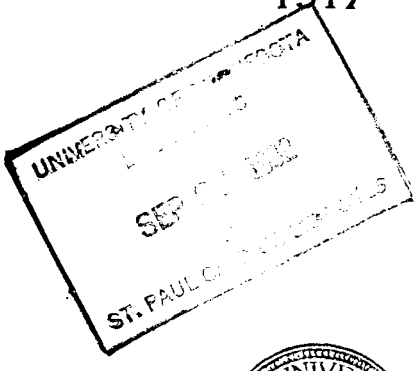
AGRICULTURAL EXPERIMENT STATION

REPORT OF NORTHEAST DEMONSTRATION FARM AND EXPERIMENT STATION DULUTH

1917



UNIVERSITY FARM, ST. PAUL
APRIL 1918

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NORTHEAST DEMONSTRATION FARM AND EXPERIMENT STATION, DULUTH

M. J. THOMPSON, Superintendent

The following is a summary of the experimental and demonstrational work in progress during 1917 at the Northeast Substation of the University of Minnesota, Department of Agriculture, located near Duluth.

THE SEASON OF 1917

The season of 1917 was rather unfavorable, owing to cold and drouth. Pastures, forage crops, and potatoes suffered, but grain and roots yielded well. It was a season of contrasts. There was scant snowfall till March. The ground froze to a depth of six feet or more with consequent injury to clover and winter cereal crops. The March snowfall broke all records for a single day or month. May and November equalled previous low records for rainfall, while October and December broke all records for low temperature. The dry season put the soil in excellent shape for planting and later tillage.

TABLE I

TEMPERATURE AND PRECIPITATION FOR 1917

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Mean maximum temperature, degrees.....	16	13	*	43	60	69	78	72	65	41	42	14
Mean minimum temperature, degrees.....	−4	−10	11.6	24	30	40	52	47	42	26	26	−5
Mean temperature, degrees—1917	6	2	..	33	45	54	65	59	53	33	34	5
Mean temperature, degrees—normal or average	10	9.7	..	37	48	58	64	63	54	42	26	15
Maximum temperature, degrees	40	37	..	55	83	83	94	87	79	58	61	37
Minimum temperature, degrees	−30	−32	−22	10	20	27	36	28	24	8	11	−35
Precipitation, inches—1917	0.44	0.91	3.02	1.4	0.64	1.91	2.95	1.75	1.9	3.7	0.05	1.22
Precipitation, inches—normal	0.98	0.99	1.55	2.14	3.47	4.53	3.65	3.53	3.6	2.71	0.6	1.22

* Maximum thermometer out of order for nine days in March.

FIELD CROP TRIALS

In coöperation with the Division of Agronomy and Farm Management of the Central Experiment Station

OATS

Five varieties of oats were under test. The 1917 crop required from two to three weeks longer to mature than the 1916 crop. The time unit varied from 108 days for Minnesota No. 261 (Kherson) to 133 days for White Russian (side). For the last three years the earlier varieties have done better than the later ones. It has been necessary to grow the variety test crops of oats, barley, and peas on new, rough, unfertilized land. This accounts for the relatively lower yields of these crops. The average production per acre for the three-year period, 1915 to 1917, was: Minnesota No. 26, 51 bushels; Minnesota No. 295, 49 bushels; Minnesota No. 281, 43 bushels; White Russian, 42½ bushels; Minnesota No. 261, 40 bushels.

BARLEY

Four varieties of barley were grown. The time required to grow this crop varied from 104 days for White Hull-less to 111 days for Princess, or about 17 days longer than in 1916. Minnesota No. 105 has given the best yields for the two-year period. White Hull-less has surpassed in earliness of maturity, while the two-row type has been disappointing in both respects. For the two-year period, Minnesota No. 105 averaged 23½ bushels per acre; White Hull-less, 19½ bushels; Oderbrucker, 19 bushels; Princess, 13 bushels.

FIELD PEAS

Five varieties of peas were grown. For two years out of three Minnesota No. 95 peas have frozen down. For the remaining four, the growing period varied from 104 days for Alaska and common to 124 days for Arthur, an average of 24 days more than in 1916. Variety yields for 1917 were: Arthur, 16.6 bushels per acre; Alaska, 16 bushels; Marrowfat, 13.3 bushels; Common, 12.4 bushels.

HAY

Owing to the dry season the hay crop was the lightest in years. The following yields were secured from various fields: Old pasture grown up to timothy, 1.13 tons per acre; two-year-old seeding, 1.6 tons per acre; seedings of 1916, 1.94 tons per acre. One cutting only is made each season, and manure is applied to the stubble.

POTATOES

In coöperation with the Division of Horticulture of the Central Experiment Station

A study was made of the effect of place on the Early Ohio variety of potatoes. Potatoes of the same variety were obtained from different places and grown on the same soil under like conditions to see what difference would occur in type and yield. Seed stock was obtained from southern Minnesota and from three potato-growing sections of the central and northern parts of the state.

TABLE II

EFFECT OF PLACE ON TYPE AND YIELD OF EARLY OHIO POTATOES

Number	Source of stock	Yield per acre		
		Firsts	Seconds	Total
		Bu.	Bu.	Bu.
4/17/D17	Faribault	136.15	38.20	174.35
8/17/D17	Hawley	162.97	15.94	178.91
7/17/D17	Moorhead	185.22	16.37	201.59
2/17/D17	Anoka	170.85	38.06	208.91
6/17/D17	Duluth	191.57	17.57	209.04
3/17/D17	Grand Rapids	198.18	32.65	230.83

Altho this work has been carried on but one year and conclusions can not be drawn, it would seem that northern-grown seed excels in vigor and productive power. An examination of the potatoes showed a marked tendency toward a uniform type, especially on the part of the northern-grown stock.

MISCELLANEOUS CROPS

The unfavorable season seriously affected miscellaneous crops under test. Frost injured 15 varieties of corn (sweet, flint, and popcorn) fully a month before maturity. Buckwheat, Proso and Siberian millets were affected in like manner. Flax matured in 105 days and speltz in 118. American Purple Top rutabagas out-yielded other varieties.

ORCHARD TRIALS

The fall of 1916 was unusually dry and the winter following was deficient in snowfall until March. As a consequence, orchard stock suffered severely. Basing the percentage of trees killed or very severely injured upon the total number of that variety, the following losses were suffered: Hibernal, 10.6 per cent; Wealthy, 11.3 per cent; Duchess, 22 per cent; Anisim, 19.7 per cent; Patten's Greening, 25.0 per cent; Okabena, 31.3 per cent. This follows very closely the observations on hardihood made the previous winter. Perfection cur-

rant and Carrie gooseberry promise very well. Minnesota No. 1 and No. 4 raspberry and No. 3 and No. 935 strawberry, obtained from the Fruit Breeding Farm at Zumbra Heights last spring, made good growth this season and produced some fruit.

Soil fertility in the orchard is being maintained by green manuring. A crop of rye sown in October, 1916, was turned under early in July, 1917, and rutabagas sown. These in turn were disked in, in October and rye again sown which will be plowed under in July, 1918.

FERTILIZER TRIALS

A. PHOSPHATE AND MANURE EXPERIMENTS

In coöperation with the Division of Soils of the Central Experiment Station

The fertilizer work was begun in 1916 when potatoes and rutabagas were grown with applications of ground rock phosphate and acid phosphate alone and in combination with manure. This work was repeated in 1917 and extended to cover oats. Lime was applied to the west half of each plot in the fall of 1916. This new factor will probably become more prominent in connection with the clover plots of 1918.

KEY TO TABLES III, IV, V

Plots 1, 7, 13—Check plots

Plots 2, 8, 14—Rock phosphate, 1 ton per acre

Plots 3, 9, 15—Rock phosphate, 1 ton per acre
Manure, 10 tons per acre

Plots 4, 10, 16—Manure, 10 tons per acre

Plots 5, 11, 17—Manure, 10 tons per acre
Acid phosphate, 360 pounds per acre

Plots 6, 12, 18—Acid phosphate, 360 pounds per acre

Rock phosphate was applied in May, 1916. Manure was applied annually on the grain stubble and the acid phosphate is distributed over the cultivated crop of potatoes and rutabagas.

The dry season of 1917 possibly accounts for the poorer showing of the manured land as compared with the 1916 crop, as soil conditions were less favorable for the thoro mixing of manure and soil, for the proper movements of soil water, and for the decay of manure and the release of fertility.

The data confirm the results of 1916 with maximum yields on manure plots. The yields of tops are erratic. Plant lice were especially bad this year on the first three plots of each series and on the limed half, thus materially reducing the yield of tops.

TABLE III

POTATO YIELDS ON PHOSPHATE-MANURE PLOTS

Plot	Treatment	Yield per acre			
		1916	1917		
			Limed	Unlimed	Total
1	Check	278.0	138.6	145.3	142.0
2	Rock phosphate	223.0	216.6	193.3	205.0
3	Rock phosphate and manure	215.0	184.0	150.0	167.0
4	Manure	176.0	172.6	147.0	160.0
5	Manure and acid phosphate	185.0	202.0	186.6	194.3
6	Acid phosphate	175.0	180.0	155.0	168.0
7	Check	116.0	205.3	210.6	208.0
8	Rock phosphate	157.0	168.0	138.0	153.0
9	Rock phosphate and manure	233.0	148.0	186.0	167.0
10	Manure	223.0	178.7	170.0	174.3
11	Manure and acid phosphate	213.0	182.6	162.6	172.7
12	Acid phosphate	137.0	148.0	155.3	151.7
13	Check	91.0	136.8	107.3	122.0
14	Rock phosphate	119.0	142.0	118.0	130.0
15	Rock phosphate and manure	133.0	96.0	124.66	110.3
16	Manure	125.0	130.0	122.0	126.0
17	Manure and acid phosphate	127.5	155.3	152.6	154.0
18	Acid phosphate	116.0	124.6	100.66	113.7
Averages					
	Check plots	161.66	160.2	154.4	157.3
	Rock phosphate	166.3	175.5	149.76	162.66
	Rock phosphate and manure	193.66	143.66	153.55	148.1
	Manure	174.66	160.4	146.33	153.43
	Manure and acid phosphate	175.16	180.0	167.11	173.67
	Acid phosphate	142.66	164.0	155.1*	159.5

* Plot 18 occupies muck soil, distinct from the clay of the other plots. Since the potatoes froze down a week earlier, the yields are not included in the average.

TABLE IV

YIELDS OF RUTABAGAS ON PHOSPHATE-MANURE PLOTS

Plot	Treatment	Yield per acre							
		1916		1917					
				Limed		Unlimed		Entire plots	
		Roots	Tops	Roots	Tops	Roots	Tops	Roots	Tops
		Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1	Check	14.5	1.82	1.14	1.3	1.5	0.5	1.32	0.0
2	Rock phosphate	16.75	3.7	7.54	3.6	8.02	5.22	7.78	4.41
3	Rock phosphate and manure	15.95	4.63	7.2	3.22	14.0	4.4	10.6	3.81
4	Manure	10.05	4.65	15.2	5.2	17.84	6.6	16.52	5.9
5	Manure and acid phosphate	17.0	4.4	11.96	4.24	12.0	2.96	11.98	3.6
6	Acid phosphate	15.25	2.95	6.0	3.2	11.2	4.0	8.6	3.6
7	Check	14.05	3.25	12.8	3.5	13.2	2.1	13.0	2.8
8	Rock phosphate	17.0	2.32	14.9	3.2	14.62	4.0	14.76	3.6
9	Rock phosphate and manure	21.0	2.15	13.8	4.82	14.2	5.6	14.0	5.21
10	Manure	19.0	2.41	8.8	5.34	14.0	5.0	11.4	5.17

TABLE IV—*Continued*

YIELDS OF RUTABAGAS ON PHOSPHATE-MANURE PLOTS

Plot	Treatment	Yield per acre							
		1916		1917					
				Limed		Unlimed		Entire plots	
		Roots	Tops	Roots	Tops	Roots	Tops	Roots	Tops
		Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
11	Manure and acid phosphate	19.0	1.78	6.48	5.2	13.16	4.0	9.82	4.6
12	Acid phosphate	18.1	1.87	5.6	4.4	8.16	2.8	6.88	3.6
13	Check	17.3	2.03	8.32	7.16	3.12	2.0	5.72	4.58
14	Rock phosphate	13.65	2.15	4.40	5.2	7.84	6.0	6.12	5.6
15	Rock phosphate and manure	13.85	1.78	8.8	5.2	12.6	4.72	10.7	4.96
16	Manure	15.7	1.92	17.44	8.82	15.56	7.0	16.5	6.91
17	Manure and acid phosphate	12.5	1.94	8.36	2.0	11.44	2.76	9.9	2.38
18	Acid phosphate	....	....	7.34	2.16	6.0	2.0	6.67	2.08
Averages*									
	Checks	15.28	2.36	7.42	3.99	5.94	1.53	6.68	2.76
	Rock phosphate	15.8	2.42	8.95	4.0	10.16	5.07	9.55	4.54
	Rock phosphate and manure	16.93	2.85	9.93	4.41	13.6	4.9	11.77	4.66
	Manure	17.91	2.99	13.81	5.79	....	6.25	14.81	5.99
	Manure and acid phosphate	16.17	2.7	8.93	3.75	12.2	3.24	10.57	3.52
	Acid phosphate	16.67	2.41	6.31	3.25	8.45	2.93	7.38	3.09

* Yield on Plot 18 is not included in the average.

TABLE V

OAT YIELDS ON PHOSPHATE-MANURE PLOTS

Plot	Treatment	Yield per acre	
		Grain	Straw
		Bu.	Tons
1	Check	27.46	0.93*
2	Rock phosphate	39.0	0.61†
3	Rock phosphate and manure	52.03	1.08
4	Manure	46.25	0.91
5	Manure and acid phosphate	52.03	1.15
6	Acid phosphate	60.7	0.97
7	Check	60.7	0.86
8	Rock phosphate	54.92	1.01
9	Rock phosphate and manure	54.92	1.14
10	Manure	66.48	1.19
11	Manure and acid phosphate	54.92	1.24
12	Acid phosphate	60.7	1.21
13	Check	60.7	1.1
14	Rock phosphate	69.37	1.18
15	Rock phosphate and manure	69.37	1.28
16	Manure	66.48	1.41
17	Manure and acid phosphate	69.37	1.58
18	Acid phosphate	66.48	1.71
Averages			
	Checks	49.61	0.96
	Rock phosphate	54.44	0.94
	Rock phosphate and manure	58.77	1.16
	Manure	59.74	1.17
	Manure and acid phosphate	58.74	1.34
	Acid phosphate	62.63	1.3
	All plots	57.23	1.13

* Partly eaten off. † Partly lodged.

The crop of 1917 was the first grain taken off the fertilizer plots. The fertilizer applications were made in 1916 on the potato-rutabaga crop. The crop on Plot 1 was eaten off slightly and that on Plot 2 lodged. The yields were consequently reduced on these plots.

B. CLOVER UTILIZATION

The clover utilization work is designed to show the comparative effect on soil of taking off the clover crop as hay, of pasturing it, and of plowing it under at the time of maximum growth. The first year six plots are sown to clover with oats as a nurse crop. The second year hay is harvested off two plots and weighed, two plots are pastured, and two are plowed under. In 1917 the two hay plots—3 and 3—yielded 1.05 tons and 1.12 tons respectively; the pasture plots—1 and 4—each maintained a cow for twelve days; Plots 2 and 5 were plowed under in August.

PASTURE TRIALS

A. PASTURE VALUES IN PRODUCING BUTTERFAT

The work on pasture values described in the 1915 and 1916 reports was continued in 1917. No grain was fed this season and the period of record dates from June 1 to October 1. No credit is given for pasturage after October 1, nor for the gains in weight recorded. Grade Guernsey cows were used. The drouth made the pasturage inferior to that of 1916.

Average weight of cows June 1, pounds	831.5
Average weight of cows October 1, pounds	891.0
Average gain in weight per cow, pounds	60.5
Total production of butterfat, four cows—122 days, pounds	374.5
Average price of butterfat, June 1 to October 1, cents	43.5
Total value of product, day and night pasture, 4 months	$162.90
Total value of product, day pasture only, 4 months	$81.45
Total value of product, day pasture only, per acre	$16.29

B. PASTURE VALUES FOR YOUNG STOCK

Weights of stock were taken June 1 and October 18, the beginning and close of the day and night pasture season. Day pasture continued until December 1. Water was available but no grain was fed. The drouth of 1917 affected pastures severely, and the young stock suffered more than mature cattle. The average daily gain was 0.527 pound as compared with 1.59 pounds in 1916.

C. PASTURE VALUES FOR WORK HORSES

Number of horses fed	4
Average weight of horses, stall feeding, period 1,* pounds	1,378.0
Average weight of horses, pasture feeding, period 2,† pounds	1,381.0
Hay consumed daily per horse, period 1, pounds	18.0
Hay consumed daily per horse, period 2, pounds	8.0
Daily saving—four horses—while on pasture	$1.30
Duration of pasture, months	4
Monthly saving on roughage	$9.00
Seasonal saving on roughage	$27.00

In spite of heavy midsummer work and the poor pasture of the season, the horses kept up weight on night pasture. To feed saving must be added the labor saved in barn chores, in the health of the horses and in the utilization of feed that otherwise probably would have been wasted.

FEEDING TRIALS

A. SELF-FEEDERS FOR YORKSHIRE PIGS

Two litters of pigs are produced annually from each brood sow, grown to six weeks of age, and sold to farmers. They are weaned when four weeks old and given a milk ration and access to a self-feeder. It was difficult to get the same feeds at all times, so a variety was fed. The pigs consumed 30 pounds of tankage worth $1.20; 30 pounds of ground oats worth 53 cents; 150 pounds of shorts worth $3; 80 pounds of hominy worth $2.40; 384 gallons of skim milk worth $15.52; 194 gallons buttermilk costing $1.94. The total value of dry feeds was $8.26, and of milk $17.46. Sixty-four pigs were fed. Each pig consumed 5½ pounds of dry feed at a cost of 13 cents, and 9 gallons of skim milk and buttermilk at a cost of 28 cents. The total cost of feeding pigs from weaning time to sale was 41 cents each. They sold for $5 each.

B. MAINTENANCE OF BROOD SOWS

The eight brood sows were fed one grain and one rutabaga ration daily during the winter of 1916-1917 and came through nicely. They consumed 1½ per cent grain ration, garbage and skim milk and buttermilk during the late spring. After weaning spring litters and breeding for fall litters, the following data were taken:

* Period 1, June, October, November.

† Period 2, July, August, September.

Date	Average weight of sows	Ration fed
	Pounds	
July 7....	229	One pound of grain per hundredweight, pasture, and milk
Aug. 5....	245	Same ration until Aug. 15, then buttermilk and pasture only until Sept. 20
Sept. 5....	236	One pound of grain, pasture, and buttermilk from Sept. 20
Oct. 20....	263	

It is evident pastures were too short to maintain weight, supplemented by milk alone. The normal seasonal ration of 0.5 pound of grain per hundred pounds in addition to pasture and buttermilk might have sufficed, but the 1-pound ration insured strong fall litters. Each sow consumed 3 pounds of grain daily, at a cost of 5½ cents, and 1.75 gallons of buttermilk costing 1¾ cents, making the total cost daily of purchased feeds, exclusive of pasture, 7¼ cents.

C. WINTER FEEDING OF HEIFERS

The study of winter feeding of heifers was planned to learn what could be done with local, farm-produced feeds in growing heifers. It supplements the summer pasture work. The animals were allowed what hay they would eat, 5 pounds of roots, and 2 pounds of grain.

Name	Age	Weight Dec. 1, 1916	Weight June 1, 1917	Gain
	Months	Pounds	Pounds	Pounds
Helen	14	555	601	46
June 2nd	12	489	560	71
Angeline 2nd	10	472	584	112
Climax 2nd	8	363	515	152

LAND-CLEARING TRIALS

A. LAND-CLEARING PRACTICE

Considerable clearing was done at the Station in 1917, combining the use of dynamite and the stump-puller. The plan followed was to pull the stump first and blast afterwards. Labor was scarce, so a boy was used with the team, and a man and a boy on the cable. In two and three fourths days of nine hours each, or twenty-five hours, 2.8 acres were pulled, or one acre in nine hours. The stumps were removed entirely and were not allowed to drop back into the holes.

It took no longer to blast the stumps after pulling than before and there was a saving in dynamite. Fully three fourths of the stumps were blasted with one-half stick (one-fourth pound) of twenty per cent dynamite. The stumps range in diameter from twelve to fifteen inches. It would seem that on high land with stumps having at least

partly dead root systems, this plan is quite effective if properly carried out. With ordinary labor it is not difficult to pull twenty stumps an hour if relatively numerous, and many more can be removed as the crew gains experience. One man can easily blast fifty stumps a day, after pulling.

B. COMPARATIVE EFFICIENCY OF 30 PER CENT AND 20 PER CENT DYNAMITE

The land clearing was done in August, 1917. The loose, rotted stumps were pulled first. A census of the remaining stumps was taken as to number, kind, condition, and size. They were then blasted. By incomplete removal we mean that some portion is left that will require some power to remove it. Thirty per cent dynamite is known as stumping powder and the lower grade is called farm powder. The following table summarizes the data:

	Tract I	Tract II
Area, acres	1.25	1.62
Number stumps	70	121
Percentage green	33.0	41.3
Percentage dead	67.0	58.6
Percentage pine	41.4	31.4
Percentage birch	28.7	31.4
Percentage balsam	25.7	28.1
Percentage cedar	.....	3.3
Percentage popple	.....	4.9
Percentage miscellaneous	4.2	0.9
Average diameter, inches	14.37	13.8
Stumps completely removed	10	15
Percentage strength dynamite	20	30
Number one-half pound sticks	98	112
Cost per pound, cents	17	19
Cost per stump, total, cents	11.9	8.79
Cost per stump removed	13.91	10.03

Altho the stumps blasted with 30 per cent dynamite were a trifle smaller, more of them were green. The cheapest work was done with the stronger powder.

POULTRY PROJECT

Poultry work is carried on as a commercial enterprise. The flock consists of 65 per cent Single Comb White Leghorns and 35 per cent Single Comb Rhode Island Reds. As far as possible farm-produced feeds are fed—barley, skim milk and buttermilk, oats, roots, clover, oats and rye sprouts. The flock is divided into a breeding flock of mature hens and a producing flock of pullets, all stock running in flocks of 100. They go into winter quarters about the first of October. The

Leghorn pullets began laying when five months and four days old, the Rhode Island Reds when eight months and nine days. Returns are given for the last two years. The yearly record begins November 1.

	1915-16	1916-17
Average number of hens in flock	164	185
Total number of eggs produced	17,680	25,095
Number of eggs per hen	107	135
Gross returns per hen, eggs and stock	$4.75	$6.14
Gross cost of feed and consumable supplies	2.58	3.81
Net returns over cost of feed and consumable supplies	2.17	2.33
Increase in gross returns per hen, per cent		29.2
Increase in gross cost of feed and consumable supplies per hen, per cent		47.6

Altho there is an actual increase in net return over cost of maintenance of 16 cents per hen, the cost of maintenance (feed and consumable supplies) has increased 18.4 per cent more than the value of the product per hen. By the use of good cockerels, and rigid culling of hens in August and pullets in January it was possible to somewhat balance the effects of war-time prices.

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